

WHAT IS CLAIMED IS:

1 1. A semiconductor switch driving circuit comprising:

2 a transformer;

3 a primary side area provided on the primary side of the  
4 transformer for controlling current on the primary side of the  
5 transformer according to a control signal for controlling a  
6 semiconductor switch; and

7 a secondary side area provided on the secondary side of the  
8 transformer for directly driving a switching device, voltage  
9 between the gate and the emitter of the switching device being  
10 continuously kept positive, voltage between the gate and the  
11 emitter being continuously kept negative and voltage between the  
12 gate and the emitter being alternately switched in positive and  
13 negative.

1 2. A semiconductor switch driving circuit according to Claim  
2 1, wherein, in the primary side area, a control signal is input  
3 to transmit power for controlling plural switching devices to the  
4 secondary side area and back electromotive force caused when  
5 current flowing in the transformer is cut off is absorbed.

1 3. A semiconductor switch driving circuit according to Claim  
2 1, the secondary side area receives the power supplied from the  
3 primary side area and transmits the power for controlling plural  
4 switching devices to the plural switching devices, and the plural

5 switching devices receive the power supplied to the secondary side  
6 area of the semiconductor switch driving circuit and cause or  
7 prevent current to flow for switching.

1 4. A semiconductor switch driving circuit according to Claim  
2 1, wherein the source of P channel MOSFET is connected to a power  
3 terminal, the drain of the P channel MOSFET is connected to the  
4 anode of a diode, the cathode of the diode is connected to a terminal  
5 at one end of a primary winding of a transformer and back  
6 electromotive force between the terminal at one end of the primary  
7 winding of the transformer and a terminal at the other end of the  
8 primary winding of the transformer is inhibited when the P channel  
9 MOSFET conducts.

1 5. A semiconductor switch driving circuit according to Claim  
2 1, wherein in the primary side area, a control signal input terminal  
3 (PL) is connected to the base of an NPN bipolar transistor (108)  
4 via a resistor (105) and a capacitor (104) respectively connected  
5 in parallel, the base and the emitter of the NPN bipolar transistor  
6 (108) are connected via a resistor (106) and the emitter is connected  
7 to a ground terminal (GND), the collector of the NPN bipolar  
8 transistor (108) is connected to the gate of a P channel MOSFET  
9 (110) via a resistor (107), the gate and the source of the P  
10 channel MOSFET (110) are connected via a resistor (109) and the  
11 source is connected to a power terminal (VDD), the drain of the P

channel MOSFET (110) is connected to the anode of a diode (111), the cathode of the diode (111) is connected to the drain of a N channel MOSFET (114) and a terminal (127a) of a primary winding of a transformer (127), the gate and the source of the N channel MOSFET (114) are connected via a resistor (113) and the source is connected to a ground terminal (GND), a control signal input terminal (N) is connected to the gate of the N channel MOSFET (114) via a resistor (112), a control signal input terminal (NL) is connected to the base of an NPN bipolar transistor (120) via a resistor (117) and a capacitor (116) respectively connected in parallel, the base and the emitter of the NPN bipolar transistor (120) are connected via a resistor (118) and the emitter is connected to a ground terminal (GND), the collector of the NPN bipolar transistor (120) is connected to the gate of a P channel MOSFET (122) via a resistor (119), the gate and the source of the P channel MOSFET (122) are connected via a resistor (121) and the source is connected to a power terminal (VDD), the drain of the P channel MOSFET (122) is connected to the anode of a diode (123), the cathode of the diode (123) is connected to the drain of a N channel MOSFET (126) and a terminal (127d) of the primary winding of the transformer (127), the gate and the source of the N channel MOSFET (126) are connected via a resistor (125) and the source is connected to a ground terminal (GND), a control signal input terminal (P) is connected to the gate of the N channel MOSFET (126) via a resistor (124), terminals (127b, 127c) of the primary winding of the

37 transformer 127 are connected to a center tap (135), the center  
38 tap (135) is connected to a power terminal (VDD) and is connected  
39 to a ground terminal (GND) via a capacitor (115).

1 6. A semiconductor switch driving circuit according to Claim  
2 2, wherein the secondary side area is provided with plural switching  
3 devices and plural gate driving sections for respectively directly  
4 driving the switching device and the switching devices are  
connected in series.

5 7. A semiconductor switch driving circuit according to Claim  
6 6, wherein the switching device is an insulated gate bipolar  
transistor (IGBT).

7 8. A semiconductor switch driving circuit according to Claim  
2 1, wherein the secondary side area has a Zener diode for preventing  
3 electromotive force generated on a secondary winding by back  
4 electromotive force caused on a primary winding of the transformer.

1 9. A semiconductor switch driving circuit according to Claim  
2 1, wherein, in the secondary side area, a terminal at one end of  
3 a secondary winding of the transformer is connected to a first  
4 Zener diode,

5 a second Zener diode is connected to a gate of a specific  
6 switching device via a first resistor, wherein same kind of

7 polarities of the first and the second Zener diode are directly  
8 connected in series with the polarities face to face,

9 a terminal at the other end of the secondary winding of the  
10 transformer is connected to the emitter of the specific switching  
11 device,

12 a second resistor and a capacitor are connected between the  
13 second Zener diode and the emitter of the specific switching device,  
14 and

15  
16 wherein a structure comprising the secondary winding of the  
17 transformer and the switching device connected via a gate driving  
18 section is plurally provided.

19  
20 10. An electrotherapy apparatus for supplying a high-voltage  
21 electric pulse to a living body for electrotherapy comprising:

22 a semiconductor switch driving circuit containing:

23 a transformer;

24 a primary side area provided on the primary side of the  
25 transformer for controlling current on the primary side of the  
26 transformer according to a control signal for controlling a  
27 semiconductor switch; and

28 a secondary side area provided on the secondary side of the  
29 transformer for directly driving a switching device, voltage  
30 between the gate and the emitter of the switching device being  
31 continuously kept positive, voltage between the gate and the

13 emitter being continuously kept negative and voltage between the  
14 gate and the emitter being alternately switched in positive and  
15 negative,  
16 wherein the high-voltage electric pulse is supplied via the  
17 switching device.